THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A microscope or endoscope, comprising:

a light source;

a flexible light transmitter for receiving and transmitting excitation light from said light source;

an optical element with a forward end for receiving said excitation light from said light transmitter and a rear wall having an internal surface for reflecting said excitation light laterally; and

an external sleeve enclosing said optical element and transparent to said excitation light in at least a region of said sleeve where said light is directed by said internal surface;

wherein said internal surface has an optical figure suitable for focussing said excitation light to a point observational field external to said sleeve.

2. A microscope or endoscope as claimed in claim 1, wherein the optical element is rotatable, and said microscope or endoscope includes a drive coupled to said optical element, for rotating said optical element so that said point observational field can be scanned.

3. A microscope or endoscope as claimed in claim 2, wherein the drive comprises an electrical motor located external to said optical element and adjacent to said rear surface of said optical element.

4. A microscope or endoscope as claimed in claim 2, wherein the drive comprises an inner sleeve for supporting and rotating said optical element, whereby said light can be scanned relative to a sample by rotating said inner sleeve and thereby the direction in which said excitation light is focussed by said internal surface.

5. A microscope or endoscope as claimed in claim 4,

wherein the drive includes an electrical or other motor for rotating the inner sleeve.

6. A microscope or endoscope as claimed in claim 1, wherein the internal surface is a section of an ellipsoid, whereby the optical element is adapted to receive said light from a substantially point source.

7. A microscope or endoscope as claimed in claim 1, wherein the internal surface is a section of a paraboloid, whereby the optical element is adapted to receive said excitation light in substantial parallel form.

8. A microscope or endoscope as claimed in claim 1, wherein said optical element includes at least one further optical element for changing said excitation light from a divergent beam into a substantial parallel beam, and the internal surface is a section of a paraboloid.

9. A microscope or endoscope as claimed in claim 1, wherein the internal surface has a reflective coating to increase the efficiency of reflection.

10. A microscope or endoscope as claimed in claim 1, wherein the optical element is oriented with the rear wall proximal to said light source.

11. A microscope or endoscope as claimed in claim 10, wherein the flexible light transmitter includes a bend in order to direct said excitation light towards said internal surface.

12. A microscope or endoscope as claimed in claim 10, further including a mirror for receiving said light from said flexible light transmitter and directing said excitation light towards said internal surface of said optical element.

13. A microscope or endoscope as claimed in claim 1, further including a short coherence length light source and a beamsplitter, for performing simultaneous optical coherence tomography.

14. A microscope or endoscope as claimed in claim 1, provided with or as a hand-held probe housing said optical element.

15. An optical head for an endoscope or microscope, comprising:

an optical element with a forward end for admitting excitation light from a light source, and a rear wall having an internal surface for reflecting said excitation light laterally, wherein said internal surface has an optical figure suitable for focussing said excitation light; and

an external sleeve enclosing said optical element and transparent to said excitation light in at least a region of said sleeve where said excitation light is directed by said internal surface.

16. An optical head as claimed in claim 15, wherein the optical element is rotatable, and said head includes a drive coupled to said optical element, for rotating said optical element so that said point observational field can be scanned.

17. An optical head as claimed in claim 15, further including a beamsplitter for separating out light from a short coherence length light source, for performing simultaneous optical coherence tomography.

18. An optical head as claimed in claim 15, provided in a hand-held probe.

19. An optical element comprising:

a forward end for admitting light from a light source;

a rear wall having an internal surface for reflecting said light laterally; and

an external sleeve of non-uniform thickness;

wherein said internal surface has an optical figure suitable for focussing said light to a point observational field outside said sleeve, said external sleeve is rotatable, translatable or both rotatable and translatable relative to said optical element whereby the distance of said point from said sleeve can be varied, and said external sleeve is transparent to said light in at least the region where said light is directed by said internal surface.

20. An optical element as claimed in claim 19, further including a beamsplitter for separating out light from a short coherence length light source, for performing simultaneous optical coherence tomography.

21. An optical element as claimed in claim 19, provided in a hand-held probe.

22. A microscope or endoscope as claimed in claim 1, wherein the external sleeve is composed of a polymer with a refractive index identical with or comparable to an expected specimen in at least a region of said external sleeve where said excitation light is directed by said internal surface, for transmitting said light and return light.

23. An optical head as claimed in claim 15, wherein the external sleeve is composed of a polymer with a refractive index identical with or comparable to an expected specimen in at least a region of said external sleeve where said excitation light is directed by said internal surface, for

transmitting said light and return light.

24. An optical element as claimed in claim 19, wherein the external sleeve is composed of a polymer with a refractive index identical with or comparable to an expected specimen in at least a region of said external sleeve where said excitation light is directed by said internal surface, for transmitting said light and return light.

25. A microscope or endoscope as claimed in claim 1, wherein the optical element is filled with a liquid that has a refractive index that matches, or is close to, the refractive index of the tissue under examination, in order to minimize refraction of light rays in passing from the interior of the block to a point observational field within a specimen.

26. A optical coherence tomograph, comprising:

a short coherence length light source;

a flexible light transmitter for receiving and transmitting light from said light source;

an optical element with a forward end for receiving said light from said light transmitter and a rear wall having an internal surface for reflecting said light laterally; and

an external sleeve enclosing said optical element and transparent to said light in at least a region of said external sleeve where said light is directed by said internal surface;

wherein said internal surface has an optical figure suitable for focussing said excitation light to an observational field external to said external sleeve.

27. A method of performing microscopy, endoscopy or optical coherence tomography, comprising:

locating an optical element in or adjacent a

specimen, the optical element having a forward end for receiving excitation light from a light transmitter and a rear wall having an internal surface for reflecting said excitation light laterally with an optical figure suitable for focussing said excitation light to an observational field in or on said specimen;

directing excitation light against said internal surface and thereby to said observation field; and

collecting by means of said internal surface return light emitted from said specimen in response to said excitation light.

28. A method as claimed in claim 27, wherein the optical element is located in an external sleeve that is transparent to said excitation light in at least a region of said sleeve where said excitation light is directed by said internal surface.

29. A method as claimed in claim 27, further including rotating said optical element, thereby effecting scanning.